THE PROGRESSIVE FISH CULTURIST

NEWS AND VIEWS FROM MANY SOURCES ON PRACTICAL HATCHERY PROBLEMS

ISSUED BY THE

U. S. DEPARTMENT OF COMMERCE
DANIEL C. ROPER, SECRETARY

BUREAU OF FISHERIES
FRANK T. BELL, COMMISSIONER

DECEMBER 1937

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THE PROGRESSIVE FISH CULTURIST

A SERIAL memorandum published occasionally for the advancement of Federal, State, and private fish culture and fishery management in fresh waters.

Editor

Elmer Higgins, Chief, Division of Scientific Inquiry, U. S. Bureau of Fisheries.

Associate Editors

Dr. H. S. Davis, In Charge, Aquicultural Investigations, U. S. Bureau of Fisheries.
Professor Lauren R. Donaldson, School of Fisheries, University of Washington.
Dr. A. S. Hazzard, Institute for Fishery Research, University of Michigan.
M. C. James, Assistant Chief, Division of Fish Culture, U. S. Bureau of Fisheries.
Dr. A. H. Wiebe, Biological Readjustment Unit, Tennessee Valley Authority.
Dr. Louis E. Wolf, New York Department of Conservation.

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MEMORANDUM I-131 WASHINGTON, D. C., DECEMBER, 1937 No. 34.

THE FISH-CULTURIST'S LIBRARY

By Albert S. Hazzard, Ph.D.,
Institute for Fisheries Research,
Michigan Department of Conservation

IN THE PAST, the fish culturist had little opportunity or incentive to study the various phases of biology associated with his profession. All he was expected to do was to raise more fish than his predecessor on the same amount of food and in the same troughs and ponds.

But times have changed. Today every hatchery employee from apprentice to superintendent must know quite a bit of fishery biology in order to handle his job with credit. Our hatcheries have become education institutions as well as fish "factories". Thousands of school children are brought out each year to one hatchery in southern Michigan to see the hatching trout eggs, the swarms of young bass or bluegills in the ponds and to observe just how fish are raised. At this same hatchery there are seldom less than a dozen cars in the parking space during the summer season, and on week-ends all our hatcheries have a steady stream of local and out-state visitors. These visitors ask questions which are not always easy to answer intelligently without a book or two handy and without some previous study of such books.

Then too, the fish culturist is now expected to have other interests than simply raising fish. He must know quite a bit of fish ecology -- what sorts of waters are best suited to different species of fish; what are the food, shelter and spawning requirements of each age class of the fish he plants; and, most difficult of all, which lakes and streams are in greatest need of stocking.

When most fish were planted as fry, losses from disease and problems of nutrition were few. Now that fish are held longer, the fish culturist must be able to diagnose the common diseases as soon as they appear and know what treatments will be effective. In those good old days of fry planting, the food problem was much simpler and the cost of liver was not a major item, but now the bill for food is usually the chief operating expense at the modern trout hatchery. If he is to keep down expenses, the fish culturist must know what meat substitutes have given the best results elsewhere and he must be on the look-out for a cheap, local source of such food. He must experiment with various combinations and methods of feeding for the different species, since the temperature and chemical content of his water supply will determine to a considerable degree what combinations will produce the most vigorous and rapid-growing fish at the lowest cost.

It is doubtful if it would pay the fish culturist to become an authority on animal genetics but he should be familiar with the results obtained from breeding experiments with trout in this country so as to put into practice the most advanced methods for improving his brood stocks.

These changes practically demand that the progressive fish culturist have a library close to his desk for reference not only to correctly answer questions of the ever increasing number of hatchery visitors but also to help him in his own problems. This library need not be large and it need not be expensive. By adding a few books and bulletins (many of which may be had for the askng) he will soon build up a useful source of dependable information.

Some of the most frequently used books in his library will probably be:

American Food and Game Fishes by David Starr Jordan and Barton W. Evermann, published by Doubleday, Doran & Co., Inc., Garden City, N. Y., (1923) price $5.00. This book is illustrated with 100 photographs, 200 drawings and 10 color plates of fishes. Keys by which the more important fish can be identified, and considerable information on the life histories and range, are given. An authoritative chapter on fly fishing adds to the interest of the book.

Fishes by David Starr Jordan, published by D. Appleton and Company, New York City, new rev. ed. (1925), price $7.50, has many of the same illustrations found in the first book on the list. It has chapters on the structure of fishes, how they hear, see, breathe, etc., their coloration, geographical distribution, etc. A discussion on methods of collecting and preserving fish specimens is included but there are no keys to identification such as are found in the first volume.

The man whose chief interest centers in pond culture of bass, bluegills and other warm water species, especially if he is located in the Mississippi drainage basin, will find Fishes of Illinois by Forbes and Richardson published by the Natural History Division, Urbana, Illinois (1908) price $4.00, one of the best references he can secure. It has color plates and numerous black and white drawings of all the principal species of warm water fishes and plenty of sound information on their habits. Keys for identifying these fishes are included.

Another excellent reference on the life histories of warm water fishes is The Ecology and Economics of Oneida Lake Fish by C. C. Adams and T. L. Hankinson, Bulletin of Roosevelt Wildlife Experiment Station, Syracuse, N. Y. (1927). (For price, write the Director of this station.)

The more inquiring fish culturist wants to know the names of the common watter plants and how they reproduce. If he is a fly fisherman -- and he should be -- he will have a double incentive to learn something about the food organisms which he finds in the waters or in the stomachs of his catch. Field Book of Ponds and Streams by nn Haven Morgan, published by G. P. Putnam's Sons, New York City, N. Y., (1930) price $3.50, has 325 illustrations, many in color, of water plants and animals. The chapters on aquatic insects give life histories of principal fish foods such as mayflies, stoneflies, caddis, etc. It is a compact little book that fits in the pocket.

If trout stream insects are a hobby with the fish culturist, he will find 3rd Edition 1935 Guide to the Study of Fresh Water Biology by J. G. Needham and P. R. Needham especially useful in keying out the aquatic stage. Much of the identification can be done from the drawings. It is also possible to kay out to genera many of the other stream and pond animals. With the aid of a hand lens many of the semimicroscopic plankters can be identified with the aid of this guide. This is published by the Comstock Publishing Co., Ithaca, N. Y. (1935) and sells for $1.00.

For general and easy reading in limnology, Life of Inland Waters by Needham and Lloyd, published by Charles C. Thomas, Springfield, Ill. (2d ed. 1930), price $3.50, is the best book I know. It discusses the life and living conditions of the principal aquatic plants and animals in an interesting and not too technical way. While not as useful in the field as Dr. Morgan's book, it is ideal for long winter evenings.

Animal Ecology by Charles Elton, The MacMillan Co., New York City (1930), $4.00, discusses the principles of animal relationships in a way which can be understood and enjoyed by anyone.

Outline for the Development of a Stocking Policy by G. C. Embody, privately printed by the author (Cornell University, Ithaca, N. Y., 1927) can be purchased from Dr. Embody for about 25¢ per copy. It outlines the essential factors to be considered in working up a stocking plan. The various reports of the New York Conservation Department's statewide survey of streams and lakes are developed from this outline and illustrate how the data are secured and used to formulate stocking policies. The average cost of such reports as are still available is about $2.75. Inquiries concerning these should be addressed to Dr. Emmeline Moore, Director of the Survey, Conservation Department, Albany, N. Y.

Methods for the Improvement of Michigan Trout Streams by C. L. Hubbs, J. R. Greeley and C. M. Tarzwell is Bulletin No. 1 of the Institute for Fisheries Research of the Michigan Department of Conservation (1932), price 50¢. This bulletin describes stream requirements of trout and how such requirements which are deficient or lacking may be supplied by the use of environmental improvements. A bulletin on the improve-

ment of lakes is being printed and should be avaiable shortly. It treats the needs of lake fishes and how improvements can be effected. It will be available for purchase through the Institute.

Of more immediate and practical use to fish culturists in the business of raising fish are the following:

Care and Diseases of Trout by H. S. Davis. This is Investigational Report No. 22 (1934) of the U. S. Bureau of Fisheries and can be obtained from the Superintendent of Documents, Washington, D. C., at a cost of 10¢. Probably the most useful booklet ever written for the hatcheryman, this document has been widely distributed both in this country and abroad where it has been translated into several foreign languages. Proven methods of trout culture are discussed together with more advanced feeding and breeding practices. The well illustrated section on common fish diseases, their recognition and treatment, make this book indispensable to the fish culturist.

For the fish culturist who is chiefly concerned with lowering the cost of feeding trout through the use of meat substitutes, the annual reports of the experimental work at the Cortland Hatchery, obtained from the New York Conservation Department, Albany, New York, are invaluable. Real progress has been made by this state in reducing the cost of rearing trout through the use of meat substitutes.

The New York State Fish Hatchery Feeding Chart, Its Purpose and Mechanics of peration by Charles R. Deuell, David C. Haskell and A. V. Tunison (summarized in The Progressive Fish Culturist for May 1937) describes the bookkeeping methods used by this state in recording the costs of feeding trout in the various hatcheries. This report is worthy of considerable study by fish culturists and fisheries administrators. It can be obtained by writing to the Conservation Department, Albany, N. Y.

Pondfish Culture by Percy Viosca, Jr., The Pelican Publishing Co., New Orleans, La., (1937), $4.00, is a new text on this subject. While written primarily for the amateur fish culturist, the professional will enjoy this book, especially the concluding chapters on productivity and fish culture in inland public waters.

The Bulletins, Documents and Investigational Reports of the U. S. Bureau of Fisheries published at intervals from 1872 to the present contain many articles of interest and value to fish culturists. Partially complete sets can occasionally be picked up at little cost by the alert fish culturist. A list of the more recent issues, their contents and cost can be secured by writing directly to the Commissioner of Fisheries, Washington, D. C.

The Status of Fish Culture in Our Inland Public Waters and the Role of Investigation in Maintenance of Fish Resources by W. C. Kendall is a challenge to fish culturists the world over and a copy should be in every hatchery especially for consultation by the superintendent after a particularly successful season. This is a bulletin of the Roosevelt Wildlife Station, Syracuse, N. Y. (1924). The price can be obtained by writing the Director of the Station.

Every fish culturist should be a member of the American Fisheries Society. Since its formation in 1870 it has been the official organization of fish culturists in North America. The transactions of its annual meetings are published and distributed to active members. The annual dues ($3.00) entitle members to these volumes. The majority of technical and popular contributions of value to fish culturists have appeared in these transactions. Volumes for the past five years are obtainable at $3.00 each; earlier issues still in print at $1.00 each. Application for membership or requests for volumes should be addressed to Seth Gordon, Secretary, American Fisheries Society, Pennsylvania State Game Commission, Harrisburg, Pennsylvania.

A man who raises fish is expected to know where and how they may be caught. The first question can only be answered by familiarity with the fishing waters of his district; the second he can answer either from personal experience (all too infrequent for most hatcherymen) or from reading or, preferably, both. A great many excellent books on angling have been written but most of them are specialized -- either on the art of catching one group of fishes or on fishing in one particular section of the country. Just Fishing by Ray Bergman, Penn Publishing Company, Philadelphia, Pa., (1932) price $5.00, is a general treatise on equipment and methods of angling. While the author's notes on the life history of a number of species are inaccurate, the directions for fishing are clear and given in an interesting style.

Streamcraft by George Parker Holden, D. Appleton and Co., New York, (rev. ed., 1927), price $3.00, has much information on angling methods as well as some excellent chapters on fly tying and repair of tackle. I have found it a most useful book.

For the more ambitious the following list may prove useful:

Field-book of Insects by Frank Lutz, G. P. Putnam's Sons (3d. ed. 1935), $3.50. This is particularly useful in identifying land insects found in fish stomachs.

Freshwater Biology by H. B. Ward, G. C. Whipple and collaborators, John Wiley and Sons (1918), price $7.00, is a comprehensive technical key to aquatic life.

College Zoology by Robert Hegner, The MacMillan Co., New York City, (4th ed. rev. 1936), price $3.50, is an excellent and easily read treatise on general zoology.

Limnology by Paul S. Welch, McGraw-Hill Book Co., New York (1935), $5.00, will be found useful by the advanced student of inland waters.

Standard Methods for the Examination of Water and Sewage by the American Public Health Association, Boston, Mass. (8th ed. 1936), $2.50, is the standard reference for the man concerned with determining the chemical conditions of waters.

Laboratory Manual for Chemical and Bacterial Analysis of Water and Sewage by F. R. Theroux, E. F. Eldridge and W. L. Mallmann, published by McGraw-Hill Book Co., New York City (2d. ed. rev. & enl. 1936), $2.50, is more elementary than the preceding and is easier for the man with little chemical training to follow. All the chemical reactions and reasons for various steps are explained.

This list of books for the fish culturist's library is by no means complete. It merely represents a nucleus which will expand according to the special needs or interests of the individual. The important thing is to start such a library, keep it where it can be consulted constantly and do enough reading in it to discover its possibilities. Books can never take the place of experience and intelligence in fish culture but if a fish culturist is to be truly progressive he must keep up with advances in his field and be ever adding to his store of information basic to his science.

CHLORINE TREATMENT OF BACTERIAL FIN ROT OF TROUT

By Frank H. Connell, Ph.D.,
Dartmouth College, Hanover, N. H.

IN NONE of the literature available to me have I been able to find reference to the use of chlorine in the treatment of bacterial fin rot of trout. Surber's chlorine method of treating gill disease, as reported by Davis (1934), is easily adaptable for use in pools and raceways and seems extremely effective as a treatment of bacterial fin rot. Indirect evidence indicates that it may also be effective against other skin diseases of trout.

As a hatchery is usually manned by a staff of a size designed to carry out the daily routine it is evident that a fast method of treatment, requiring a minimum of labor, is extremely desirable for checking and stamping out such epidemics as may appear. If the fast method is also the most effective method known its use is doubly appreciated, especially when no undesirable after effects, such as loss of appetite, can be noted.

From the following partially controlled experiment it appears that chlorine treatment offers just such a method.

On one of my weekly summer inspections of the New Hampshire fish hatcheries, July 28, the superintendent called by attention to some pools of Eastern brook trout fingerlings which apparently overnight had begun to die in numbers. A diagnosis of bacterial fin rot with typical lesions was made.

That portion of the hatchery in which these fingerlings were held consisted of twenty-six pools holding a total of nearly one hundred and eighty thousand fish. The pools were arranged in an upper and lower series, each series consisting of thirteen pools. Each upper series pool flowed into the lower series pool immediately below it. The pools were constructed of cement, straight sides, newly gravelled bottoms, and of dimensions approximating 50' x 4' x 18".

Fingerlings were dying in ten pools; in all cases both the upper pool and the lower pool into which it flowed were involved. Some pools were worse than others; between 250 and 350 dead fingerlings had been removed from each of the worst pools on the morning I arrived. In the other pools affected lesions could be demonstrated, though generally less far advanced and few fish were picked up.

It was obvious if the regular work was to be completed by the staff that a copper sulphate dip could not be attempted for so many fish. Having confidence in the efficacy of copper sulphate, however, we did dip the four worst pools, using a 1/2,000 solution for 1½ minutes. One pair of the least heavily infected pools was treated with potassium permanganate, 1/150,000 for 1 hour, using a modification of the constant flow siphon device described by Fish (1933). The remaining four pools were treated with chlorine.

On July 31 the situation was as follows:

1. The pools treated with permanganate were much worse, with a loss for the day of 400-500 fish per pool.

2. The pools treated with copper sulphate were much better, with a loss for the day of 6-15 fish per pool.

3. The chlorinated pools were also greatly improved, with a loss for the day of 6-12 fish per pool. The two upper pools seemed so much better that a second treatment was postponed in order that the efficacy of a single chlorine treatment might be observed.

4. The fingerlings in five of the hitherto healthy and untreated pools began to show lesions, though no loss, and were included in the treatments given on this day.

Since the chlorine method seemed as effective as the copper sulphate and required but a fraction of the time and labor necessary for dipping, we determined to give it further trial. Accordingly, 13 pools were treated - seven with copper sulphate and six with chlorine. Of the pools originally treated with permanganate, one was treated with copper sulphate and one with chlorine.

On August 4, the pools originally treated with permanganate were much better, with a small daily loss. The actual figure apparently escaped recording, but as nearly as I can recall it was less than a dozen fish per pool. Some of the pools which had by now received two treatments of copper sulphate, copper sulphate and chlorine, or chlorine alone, were showing no loss at all.

In order to play safe we then gave all twenty-six pools containing brook trout fingerlings a chlorine treatment. This process was repeated on August 10.

Loss attributable to disease ceased, and even though a period of extreme heat occurred during which the water temperature reached 73° F. on several occasions,

no other disease appeared. In the past such hot spells have signalled the approach of trouble from fungus, Gyrodactylus, etc.

Following is the procedure used by the writer for treating fish in larger pools. Handling of the fish is obviated, a most important consideration in the treatment of young rainbows.

1. The pool must be clean. Fish should not be fed from the time the pool is cleaned until after treatment. The presence of much organic matter in the pool results in rapid removal of chlorine from the water, with consequent loss of efficacy. For this reason chlorine can rarely be used successfully in old natural pools with gravel sides and bottoms.

2. The volume of water to be treated is estimated in cubic feet. In very large pools it is often convenient to pen the fish in the lower twenty-five feet of the pool and treat this restricted area. This procedure seemed effective against bacterial fin rot, but would probably prove undesirable against fungus and protozoan infections.

3. High test calcium hypochlorite (HTH) is weighed out at the rate of 0.086 grams per cubic foot of water to be treated and dissolved in water. For twenty-five feet of pool we distribute the dissolved hypochlorite about equally among four water pails, which are then filled. This makes it possible to spread the solution more evenly over the surface of the pool, and upon mixing results in an even concentration throughout the area being treated.

   Sodium thiosulphate (Hypo) is weighed out at the rate of 0.36 grams per cubic foot. This, too, is dissolved in about four pails of water. Granular hypo, if available, saves time.

4. Without even stopping the flow of water through the pool, the hypochlorite solution is spread quickly over the area to be treated. Brushes are used to mix the solution thoroughly with the water in the pool. The mixing action is continued throughout the period of treatment. If the fish have been penned behind a screen in the lower portion of the pool some of the hypochlorite solution should be thrown above the screen to take care of flow. At the end of thirty seconds the free chlorine concentration should be tested with a chlorine comparator, using ortho-tolidine indicator. The concentration should read two parts of chlorine per million parts of water. If through error, which need never occur, too much chlorine is present -- indicated by a brownish color with ortho-tolidine -- the hypo solution should be mixed into the pool immediately. The purpose of the hypo is to remove the free chlorine from the water. If the amount of chlorine present is approximately two parts per million the hypo is not thrown in until two minutes have passed from the time the chlorine hit the water. When thoroughly mixed another test of the water is made to demonstrate the complete absence of free chlorine.

After a little practice we were able to treat twenty-six pools in just under two hours, an average of about four and a half minutes per pool.

Timing is important. We use an interval timer set to ring at the end of two minutes, thus eliminating the human equation. When using chlorine, visual evidence of distress is without value because by the time the fish show signs of bunching or pointing toward the surface, it is too late to save them. Confidence must be placed in the comparator. The twisting and jumping in which individual fish indulge when the chlorine is first mixed into the pool need not be a cause for alarm.

If too strong a solution has been used and neutralized at the end of thirty sconds, or if a weak concentration results from the presence of food, etc. in the pool, no further treatment should be attempted for twenty-four hours. The effects of repeated chlorine treatments over short periods of time are cumulative. Two treatments with a weaker solution in the same day may prove fatal.

A healthy fish will stand two parts of chlorine per million parts of water for four minutes or more, even at summer temperatures. A sick fish will not. Often in the past treatment has resulted in the killing of sick fish; the weeding out chemically, as it were, of the fit from the unfit, rather than arresting disease in already sick fish and aiding in their ultimate recovery.

That chlorine will cause wholesale destruction of fish if improperly used is true; that when properly used it will stop certain diseases quickly, easily, safely, and effectively seems equally true.

References Cited

Davis, H. S. Care and Diseases of Trout, 1934, Investigational Report No. 22, U. S. Bureau of Fisheries.

Fish, F. F. The Chemical Disinfection of Trout Ponds, 1933, Trans. Am. Fish. Soc., vol. 63, pp. 158-163.

Lamotte-Enslow Chlorine Comparator may be obtained from A. H. Thomas Co., Philadelphia, Pa.

HTH, Calcium hypochlorite may be obtained from the Mathieson Alkali Works, 250 Park Avenue, New York, N. Y.

CONTROL OF "SHELLBUGS" IN POND CULTURE

By O. Lloyd Meehean
U. S. Bureau of Fisheries

THE PHYLLOPOD crustacean, Estheria, is troublesome in goldfish ponds throughout the Pennsylvania and Maryland area. It is not a predator in any sense but gathers its food from the bottom of the pond. In the process the water is roiled to such an extent that the goldfish are unable to feed sufficiently and consequently become stunted.

Experiments were conducted to control these crustacea in ponds infested with them. In the first series of experiments a study was made of the stomach contents of the phyllopods and goldfish fingerlings. It was found that the fingerlings do not feed on the bottom until they are three-fourths to one inch in length and that the Estheria worked the bottom most of the time.

With these data in mind Paris green was used in one or two ponds recently stocked with fry. There was an immediate reduction in the number of "shellbugs", but the season was late and the experiment could not be satisfactorily carried to a conclusion because the fish grew rapidly and began to feed on the bottom and no other infested ponds were available. Since the film of Paris green was spread evenly over the bottom it was felt that the fish might be killed in addition to the intended victims. It is hoped that someone may carry these experiments through in a more conclusive manner using the Paris green.

Other ponds with larger fish were heavily populated with these crustacea so another series of experiments was tried. My work in pond culture has shown me that fish will stand considerable copper sulfate but crustacea are much more susceptible. In a concrete pool it was found that goldfish will stand at least one part per million (8.33 pounds per million gallons of water). Sunfish and bass will stand considerably more.

Trials in various ponds with one part per million of copper sulfate reduced the number of crustaceans materially with no visible effect upon the fingerlings except to cause a slight distress. This was manifested by the fish gulping at the surface as if short of oxygen. A second treatment in about twenty-four hours after the first resulted in completely ridding the pond of "shellbugs".

Date	Pond	Effect	Result
July 27	3 & 4	ponds treated, fish unaffected	
July 28	3	some fish gulping air	50% shellbugs dead
	4	" " " "	67% dead
July 29	3	ponds treated, no fish killed	
		distinct odor of decay, some fish gulping air	80% dead
July 30	3 & 4	ponds treated - no fish killed	
		fish still at surface	few bugs alive
July 31	3 & 4	fish normal	no shellbugs

The above data are typical of five ponds to which the copper sulfate was applied. In every case the percentage of reduction was approximately the same. Each time the fish and Estheria were brought to the surface, and in every instance the water took on a distinct odor of decay. Only once were any fish killed. This amounted to six counted in one pond.

Directions for procedure:

1. Measure the width and length of the pond.

2. Take an adequate number of soundings to determine the average depth.

3. Calculate the total volume of water in cubic feet or gallons.

4. Spread fine crystalline copper sulfate as evenly as possible over the surface at the rate of one part per million (8.33 pounds per million gallons or 133,717 cubic feet of water) or dissolve and spray.

5. Apply three times at twenty-four hour intervals unless the fish are in serious distress, in which case the treatments may be spaced farther apart.

Accurate counts may be made of the shellbugs to follow the progress of the applications by stirring a portion of the bottom and following through with a bobinett seine. The percentage can be determined by counting the dead and live animals in the seine. The bottom should never be stirred immediately before or after the applications since sediment containing organic matter weakens the solution rapidly.

Later experiments designed to find out if the crustaceans could be eliminated by the use of less copper sulfate, either by different spacing of applications or with lighter doses, showed that the above procedure is the most efficacious. It appears that there is some cumulative effect since the wide spacing of applications necessitated the use of more treatments. In rare instances very turbid ponds may require one or more additional treatments.

GLIMPSES AT FISHERIES BIOLOGY AND FISH CULTURE IN EUROPE

III. AUSTRIA, CZECHOSLOVAKIA, POLAND, RUSSIA

By William E. Ricker,
Pacific Biological Station, Nanaimo, B. C.

THE BIOLOGICAL STATION of Lunz am See is located in lower Austria, about 150 miles from Vienna. Its situation is on a small lake of 160 acres extent, at the foot of fairly high and precipitous mountains. Founded in 1906 by private generosity, it has survived the calamities of war and inflation, which suspended its work and destroyed its endowment. At present it is jointly supported by the Vienna Akademie der Wissenschaften and the Kaiser-Wilhelm-Gesellschaft. The laboratories are built near an old chateau, originally the seat of some religious order, which now provides living accommodation for students and research workers.

Among the prominent names associated with this station are those of Prof. Dr. V. Brehm and Prof. Dr. Fr. Ruttner. The latter is now resident director of the station. The studies conducted from Lunz include chemical and biological investigations of the adjacent lakes, rivers, ponds and bogs lying at various elevations. The lower lake especially has been the subject of very intensive limnological study. It contains brown trout and saibling (char), of which the latter grow to about 25 lbs. weight, which seems an enormous bulk for a lake of that size. More recently, the activities of the station have been extended to other lakes of the region by the assistance of a portable laboratory assembled in a covered truck. Ruttner himself has been interested in most features of the lake survey including temperature, oxygen, taxonomy and distribution of the plankton, experimental studies of photosynthesis, etc. The only other worker present at the time of our visit was a chemist, Dr. F. Berger.

The study of the fish and fisheries of the Danube involves all of the several nations lying along its course, and an international committee has in fact been formed to compare and correlate the investigations being made at various points. The principal Austrian studies are carried out from the Hydrobiologische Donaustation in Vienna, whose director is Prof. Dr. A. Cerny. Just as in eastern North America the variety of the fish fauna increases from north to south, so in Europe the same phenomenon is evident in proceeding from northwest to southeast, and the Danube basin possesses a very interesting assemblage. Among its more interesting or spectaular members may be mentioned: the peculiar salmonid Hucho, the little sterlet, which occurs along with the more generally distributed sturgeon, and the giant catfish or Welse, which exceeds the largest of our channel cats.

In Prague, capital of Czechoslovakia, we met another of the senior fisheries biologists of Europe, Prof. Dr. Karel Schaferna. He is director of the department of Hydrobiology and Ichthyology in the Charles University. During the course of studies in various parts of Europe from Copenhagen to Naples, he has acquired an unusual range of languages: speaks Danish, French, German, as well as his native Czech, and related slavonic tongues like Polish and Russian; and he modestly apologized because he could only read English. (Many Europeans of all nationalities resemble him in finding it too laborious a task to reconcile English pronounciation and spelling; nor can we blame them). Schaferna's published work centres around two general topics: first, the distribution, taxonomy etc. of phyllopod and other crustaceans; and secondly, structural abnormalities in fishes (elongated fins, shortened skeleton, visceral anastomoses, etc.) and their parasites and diseases. In the latter interest he is joined by his colleague, Dr. Otto Jirovec.

There is a state institution of applied fishery biology in Prague of which Dr. Rudolf Pytlik is director, Dr. F. Volf, pathologist, and Ing. Jarnila Faskrova, chemist. Their studies have been of diseases, and the effects of pollution of waters; while Pytlik was collaborator in a peper on the fishes of Czechoslovakia, written from a popular and economic viewpoint. The German university of the capital has also a limnological department, where I searched for, but was unfortunately unable to find, Dr. Emil Dejdar. Prof. Dr. Jaromir Samal, of still another institution, has studied the food of young carp, the saibling of mountain lakes, and the growth and distribution of stoneflies.

In Czechoslovakia the pond culture of carp appears to reach is maximum development as regards its importance in the national economy, and the size of some of the individual ponds in use (their area is reckoned in square kilometers rather than hectares). In Vodnany there is a Central Fisheries Association, and a fisheries school, supplying the carp growers with information and personnel, but we were unable to extend our journey to visit this important centre.

The city of Cracow, ancient capital of Poland, is the seat of her oldest and most celebrated university, which in turn supports a modern Institute of Ichthyobiology and Pisciculture. It is directed by Prof. Dr. Theodor Spitschakoff, with a staff of several assistants. Like Ruttner and many other limnologists, Spitschakoff has a mechanical turn of mind, and has executed original designs for several pieces of apparatus; these he supplements with a discerning choice of standard items, with the result that his laboratory is very well equipped. As in Czechoslovakia, the titles of papers from this institute reflect the importance of the carp industry, and the troubles of those who pursue it, as regards the nutrition and diseases of their stock. These countries of course also have important fisheries, as opposed to fish cultural, industries including good runs of salmon to some of the large Polish rivers.

Other Polish fisheries institutions are established in Bydgoszcz (Bromberg), Poznan and Warsaw, and in the northern lake district there is an hydrobiological station near Suwalki, on lake Wigry.

Of the numerous establishments devoted to fisheries and limnological research in the Soviet Union, we visited only one, the Limnological Station of Kossino, near Moscow. The climate of the Moscow plain resembles that of northern Ontario. The station buildings had double log walls, and fires were burning vigorously to dispel the 20° or so (Centigrade) of frost which prevailed outside. The lakes which form the principal object of the labours of the station were frozen and snow covered, not easily distinguishable from adjacent meadows in the bright sunlight. Director at Kossino is Dr. L. L. Rossolimo, and as he introduced me to the various members of the staff, their faces with difficulty concealed their surprise at the presence of a mid-winter visitor from so remote a region.

The work of the station is divided into several sections, each with two to several investigators. Under General Biology may be mentioned Dr. Borutsky, whose study of the bottom fauna of lakes resembles that of Lenz at Plon, and for which he independently invented a layered dredge - illustrating once more that great minds think alike! Microbiology has been the department of Dr. Z. Kuznetsov and his associates. Much of their work has come out of the discovery by Rossolimo that certain lakes give off gases from the ooze in large quantities, which in their ascent profoundly affect the gas content of the overlying water. This in turn has resulted in occasional severe mortality of the fishes of the lakes, by reason either of insufficient oxygen or of direct poisoning. Kuznetsov has sought to demonstrte the nature of the substratum necessary for the bacteriological generation and release of these gases (chiefly methane and hydrogen) from the ooze, and to demonstrate also the presence in the water of bacteria which oxidize them after they are released. Assisting in the same investigation is the section of Chemistry, including Dr. Konshin. The section on Hydrology has been only recently established. Dr. Shelesno and his associates have undertaken the study of questions of precipitation, evaporation, inflow, ground water and runoff, and what these factors bring to and take from a lake. Finally there is the section of Fishery-Biology, including Dr. G. Z. Karzinkin and others. Karzinkin has published some useful work on rate and completeness of digestion in various fishes, also a more general discussion of biological productivity and the term "biomass".

In Moscow we also met a professor of the university, Dr. N. K. Deksbach, who has made various fisheries investigations, including, during the previous summer, a visit to the region of the northeast shore of the Caspian Sea. Other fisheries institutions and scientists are situated in Moscow, but again we refrain from attempting a list, lest ignorance of some be construed as an invidious disregard; while to attempt to enumerate such instututions for the whole Union would exceed the scope of this article. Mention must be made, however, of Prof. G. Vereshagin of the Academy of Sciences in Leningrad. The Bibliographic Committee of the International Association for Limnology, of which Vereshagin is chairman, attempts to compile a limnological bibliography for the whole world each year, for the use of scientists generally. It has been said the facilities and time at the committee's disposal, and those of their compilers in different countries, are inadequate to do the task assigned completely. (One of the principal wants is a resident compiler in U. S. A.). Another difficulty is the lack of adequate funds for publication. Nevertheless, bibliographies for several years have appeared, and Professor Vereshagin and his co-workers everywhere are to be commended for undertaking a task at once laborious to them and useful to us all.

A METHOD FOR INDUCING FISH TO SPAWN

By R. von Ihering, Ph.D., Commissao
Technica de Piscicultura do Nordeste, Ceara, Brasil.

WITH FRIENDLY GREETINGS, my best thanks for so much significant information in THE PROGRESSIVE FISH CULTURIST that constitutes a very useful text also for us in Brazil, although sometimes only indirectly so. To reciprocate, I may call the attention of the American readers to a method which, as far as I know, has been practically applied only in Brazilian fish culture.

I refer to forcing of spawning in fishes in captivity when they are unwilling to reproduce. We who are dealing with characins and nematognaths are able to obtain the needed eggs from these fishes only by pituitary injections. In the North American fishery technic, this is mostly not necessary; nevertheless there also may occur cases in which, for instance, a premature spawning may be desired, or this method may find application in such interesting experiments as those by R. E. Foerster ("Interspecific Cross-breeding of Pacific Salmon", 1935) which are partly frustrated because the ovaries of fishes kept in captivity do not ripen.

The technic of pituitary injection for the above purpose is very simple. A cross cut through the skull a little behind the eyes and two longitudinal cuts in the roof of the skull permit the baring of the brain. When the hind part of the brain is raised there may be seen the rounded, median pituitary body which is attached to the mid-brain by a stalk. Sometimes the gland is embedded in a pit in the sphenoid making its removal more difficult, but after some experience an assistant is able to remove up to 50 pituitary preparations in an hour.

Fish of 26-35 cm. have a pituitary of a size about as large as the head of a match. A fish of such size needs to be injected, according to our experience, with about 3-4 pituitaries, finely triturated, each dose being diluted with about 1 cm. of a 6 percent solution of table salt. For best results the injection is made in the back muscles, behind the swim bladder. To be sure, a test may be made by injecting writing ink into a dead fish, and then cut open to see if the needle took the right direction.

For the fishes of our fauna the pituitaries of any family or order may be used for other families. But such experiments with mammal pituitaries gave only negative results.

According to the species, or it seems according to the size of the fish, it takes either only a few hours (in "minnows") or up to 20 hours after injection before spawning occurs. When it is noted in the aquarium that not only the males, but also the females are greatly excited, it is then possible to strip and fertilize the eggs.

Our experience extends as far back as 1934, with some thousands of positive pituitary injections. Without this technic we would not have been able to judge the possibilities of the economic culture of our native species.

It is to be hoped that the method of inducing spawning by pituitary injection will be of some use, in certain difficult cases, for the readers of THE PROGRESSIVE FISH CULTIRIST, and I should be obliged to hear of the results of such applications.

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AN EDITORIAL

F I S H C U L T U R I S T S, H O L D U P Y O U R H E A D S !

I SOMETIMES THINK that a life-like portrait of the Forgotten Man would show a middle-aged individual with care-lined face, standing in hip boots and holding in one hand a bucket of ground liver and meal and in the other a feeding dipper. Fish culturists, like the Service of Supply in the Army, seldom receive citations or medals from the high command for dashing heroism or devotion to duty, and yet the Army of Conservation could boast of few laurels in the field of fisheries without the devoted labors of the Hatchery Corps. Outdoor recreation would lose much of its savor if streams as well as hillsides were denuded.

Outdoor recreation is assuming a significance and importance under modern conditions of life that was suspected only by the poet and natural philosopher of old. Year after year the United States is becoming more and more mechanized. The life of one person after another is being dominated by machinery. Human beings require compensation for these derangements of natural living and it seems inevitable that as the industrial age expands the need for an escape will become more acute. Our mental equilibrium, our social adjustments must be restored - our physical well-being requires refreshment by contacts with our Mother Earth.

Fishing is the chief object of an ourdoor expedition for at least 10 million people. It is the chief excuse for leaving the grind of office routine; it is the alibi for shirking complex business responsibility for a time. The memories of that fishing trip provide solace for the spirit during long intervals of prosaic labor.

But how can these 10 million people today, and the millions that will come after them, find good fishing? If solitude and virginal wilderness are requirements for wild creatures, how can we expect to preserve such conditions for the future? Before the coming of the white man, trout abounded in almost every mountain stream and lake but, with the westward march of the pioneer, fish habitats were destroyed; streams were stripped of their over-hanging trees that shaded and cooled the water; hills were denuded of their verdure; silt from eroding hillsides and farm lands has filled and smothered the rocky shallows and sheltering pools in our streams; their channels have been clogged with logs and sawdust; their waters have been made unfit for fish by poison from coal mines, pulp mills, municipal sewers and the like. The building of roads along our streams has filled them with rock slides and debris, and what is worse from the standpoint of the fish, highways have been opened into hitherto untouched wildernesses, attracting crowds that fill the land with their noise, the clattering of machinery, the stench of gasoline and discarded tin cans.

And yet, good fishing can still be found in many localities, particularly in the crowded East. This condition has been brought about solely through the activities of our various conservation agencies, Federal, State, and private. In this campaign for better fishing, club presidents, secretaries, and professional conservationists do the shouting; politicians do the lobbying and law making; scientists publish the papers; sportsmen do the complaining and petitioning; wardens discourage fish hogs and violators; but the fish culturists perform the necessary but unromantic jobs of scrubbing, painting, digging, constructing, and feeding and nursing the millions of fry that supply the fish. They are operating conservationists. Without their work behind the lines the advance positions won by the charges and bombardments of other services would be untenable.

Then hold up your heads, Fish Culturists, for yours is a noble job. Its responsibilities are great, and during the new year may you resolve to be worthy of them. Without discarding methods that are tested and proven, be ever alert for better ways, strive ever for higher efficiency. "Let us discard out-moded beliefs and practices and adopt new methods in tune with modern circumstances", better calculated to discharge the high trust placed upon us.

THE EDITOR.

COMMENTS FROM OUR READERS

TOO MUCH VEGETATION IN PONDS UNDESIRABLE:

AN IDEAL POND STATION

Editor, Progressive Fish Culturist:

Following my comments on one of your published letters it has been suggested to me that interested parties should submit to THE PROGRESSIVE FISH CULTURIST articles describing modifications of standard fish cultural equipment.

First by way of qualification it should be mentioned that your publication has not been followed very closely at this station, nor has the subject of modern fish culture from standard authority been fittingly pursued. Consequently the advancement of ideas has been left to those whose names might carry more weight. However, inasmuch as it has been requested and finding my own ideas verified by some standard authorities, the subject of aquatic vegetation will be discussed, assuming of course that our warm water bass ponds are standard fish cultural equipment.

Based on experience gained at southern pond stations, I have come to the conclusion that all our larger aquatic vegetation commonly found in brood ponds are only weeds which obstruct the view, consume space and fertilizer and interfere with feeding. Let me repeat that the presence of coarse vegetation in bass ponds, is a detriment to the ponds affected and should be destroyed.

When I mention "good grazing" and "fertile waters" thereby implying the importance of aquatic vegetation to fish culture, the palmella forms of algae are in mind. Since the algae furnishes one of the most important links between pond fertility and the entomostraca and performs the function of consuming carbon dioxide and giving off dissolved oxygen, we can eliminate the heavy plants on that score.

The daphnia and copepods furnish the bulk of the food supply under consideration and midges and mosquitos deposit their eggs in open water. The damsel flies can always find a sufficient number of sticks and stems upon which to lay their eggs and the dragon fly is just what his name implies - more weeds.

What benefit is derived from the few larger organisms found among coarse vegetation is nominal compared to the disadvantage of the plants themselves. The same thing will apply to the benefits from oxygen, shade, protection from predators, etc. which the larger plants are supposed to furnish. Wiebe (1935) has shown that these benefits are negligible in comparison to the disadvantages of the vegetation. Roach

& Wickliff (1934) have shown by a series of oxygen tests that vegetation can be even fatal to fish rather than beneficial from the standpoint of oxygen supply. My experience has verified these authors' findings and led me to conclude that the loss of time and fish and the additional work and expense involved are not justified by the value of the vegetation.

It is also believed that a very large percent of the fry hatched at many of our stations is never collected due to poor visibility as a result of dense growths of pond vegetation. When one or more schools of fry are allowed to break up and scatter among shallow vegetation, the pond may as well be drained and a new start made.

Then there is always the slow, painful and expensive process of raking and piling the vegetation in drawing ponds. Later it has to be pushed out, heaved on the bank and carted away. Also, there is the difficult task of separating the fish from the floating particles that clog the screens and cause the holding tanks to overflow with a loss of fish or excess handling making them weak and more susceptible to mortality after planting.

I think that parties in charge of newly constructed brood ponds should beware of carelessly planting aquatic vegetation. Thirty minutes of planting may result in years of hard and unnecessary work. The mere fact that it is an old established custom does not necessarily mean that it is a good one. I dare say that there are many stations that could double their production in two or three years by spending a good portion of their allotments and time on cleaning their ponds of these unnecessary weeds.

Summing up, let me say that my limited experience has failed to show a sufficient reason for the amount of aquatic vegetation currently grown on most of our pond stations. Instead, I have observed more and better fish produced to a given area without its use.

Now, off the record, if space permits. Will Rogers got all his knowledge from the papers, but I gained most of mine from Old Man Experience. While under some of the old liners, heaving piles of dead vegetation up the sides of frozen dykes, here is one of the air castles I built:

The actual requisites of a successful bass hatchery are: 1. A sufficient number of nursery ponds to accommodate all fry. These should be on or near the station grounds. 2. Brood ponds not too large and free of shallow feather edges, with an eighteen inch minimum depth, unless they are to be used as combination brood and rearing ponds in which case the opposite would apply. 3. Adequate water supply with gravity flow. 4. Larger facilities for daphnia production. 5. One or more extra ponds for the exclusive use of forage fish. Golden shiners in brood ponds are a nuisance but a few should be allowed to spawn in the nursery ponds - too many will compete for food causing cannibalism. 6. Well sodded dykes and perfect control of

surface water. 7. Good brood stock and fertilizer only for the brood ponds. Artificial nests and shades are just something to play with. 8. A good dairy barn in the vicinity where fresh manure may be obtained as needed for daphnia culture. Most daphnia ponds are made too rich, not drained and cleaned often enough. Daphnia, like fish, only require a certain amount of food. Any fertilizer or material used in excess of that which actually produces sufficient bacteria to feed the daphnia is a detriment to their culture and should be avoided. 9. Adequate holding tanks conveniently located with a gravity flow of fresh water. 10. Applicants who will respond to card notices and cooperate in distribution.

Again let me mention that I agree with one of our authorities who wrote, "The aesthetic value of pond vegetation is for the most part non-existant". The name of your publication suggests PROGRESS, and one would progress in fish culture with a pitchfork just about as he would progress in the wheat harvest with a hand scythe.

J. Q. McGee, in charge,
U. S. Fisheries Station,
Norris, Tenn.

CAUTION URGED IN CHEMICAL TREATMENT OF PONDS

Editor, Progressive Fish Culturist:

In the issue of THE PROGRESSIVE FISH CULTURIST that has just come to my desk there is an article by O. L. Meehean on Dactylogyrus control in ponds.

Because of certain statements in the above article it seems to me that a word of caution should be printed in your next issue. If Mr. Meehean's method is used by inexperienced goldfish men fatalities will surely result. My earlier work shows that 1 lb. of permanganate to 32,000 gallons of water will kill Dactylogyrus on goldfish under experimental conditions in cement tanks in 1½ hours but that in the case of ponds more permanganate is necessary due to the presence of organic matter which hastens the oxidation of the chemical. The ponds that I treated were shallow and had mud bottoms. The chemical in solution was sprayed over the entire pond by means of a power sprayer and every effort was made to distribute the chemical as evenly as possible. Under our conditions, 1 lb. of permanganate to 25,000 gallons of water proved effective in killing most Dactylogyrus on young fish when the fish were treated in ponds containing considerable organic matter. In ponds with very little organic matter 1 lb. was effective in 32,000 gallons of water.

Early in our experimental work I treated 5,000 adult goldfish in a cement tank that had been filled with clear water from a drilled well. We used 1 lb. of permanganate to 25,000 gallons of water, as we had been using with success in our mud bottom ponds. When we returned the next morning nearly all of the fish were dead. I wonder what 1 lb. of permanganate to 12,000 gallons of water would have done.

Experiments on the control of Dactylogyrus in ponds must take into consideration the amount of organic matter in the water or the results will be very unfortunate. Because of differences in methods of applying the permanganate and because the amount of organic matter in different waters differ so greatly it probably is advisable for each man who wishes to use permanganate in the pond treatment of fish to make certain preliminary tests to determine the amount of permanganate that should be used in his water.

Walter N. Hess,
Head, Dept. of Billogy,
Hamilton College, Clinton, N. Y.

MORE ABOUT FISH PLANTING

Editor, Progressive Fish Culturist:

The planting of hatchery fish is one of the major problems facing fish culturists at the present time. Results must be measured by increased fishing rather than hatchery production. Every hatchery man believes that artificial propagation improves fishing for the angler. Conclusive proof can be offered to substantiate this belief. But I also believe, any many fish culturists concur in this belief, that too many fish are lost between hatchery production figures and actual anglers' catches.

Here are a few of the things which I have come in contact with through observation and experience, which actually handicap the chances of survival of hatchery fish in a wild habitat; obsolete equipment, the application system of fish distribution, and ignorance of physical and biological conditions in the waters to be planted.

Let us touch on each of these points briefly. At the present time most of the equipment for the transportation of fish is out-moded. Trucks four and five years old are subject to many major ailments which are not discernible until the trouble actually starts. This necessitates many costly delays on the road and sometimes even causes the loss of an entire load of fish. A fish truck receives the hardest kind of treatment, rough roads, high speeds, and few stops. Most stations still rely on pails, ten gallon cans, or barrels for the transportation of fish. These have many obvious disadvantages; small carrying capacity, difficulties in maintaining an even temperature, loss of water on rough roads, inadequate aeration, and difficulties in "tempering in", being a few of the most important. I do not mean to imply that fish cannot be transported safely by these methods but I do contend that a good tank truck with a circulation system, ice compartment and aerating device is by far the most modern and practical method of fish transportation.

The application system for the distribution of fish has, as I see it, one outstanding defect. The applicant must plant the fish himself. Let me quote directly

from Mr. T. W. Timmens' letter in the December, 1936 issue of THE PROGRESSIVE FISH CULTURIST, ".....the applicant has about 10 or 15 minutes to plant 25 or 30 cans of trout -- to drive to the stream, hunt shallows and fast waters, to look for the best food pockets,.....". These two words "hunt" and "look" are the principal reason for the unsuccessful planting of fish by applicants. It is probable that these fish had been applied for at least one month and possibly a great deal longer, yet when the actual planting occurred the applicant hadn't determined the best place to put the fish and depended on a very hurried scrutiny to locate a suitable spot. Yet this man is above the average in his knowledge of planting requirements. To the average layman if the fish are put into water the job is completed to his satisfaction. Why can't the hatchery plant the fish in the desired locations or at least have a hatcheryman inspect the planting grounds as to suitability, number and species of fish to be planted before the application is granted?

Now for the final and possibly the most important defect in the fish planting program -- ignorance of the physical and biological conditions in the waters to be planted. Here are a few conditions of which the hatcheryman, through no fault of his own, is woefully ignorant. Fish of a certain specified number and species are desired in a certain lake or stream. It may be, when the fish are delivered, he finds that the species called for in the application are not suitable for these waters, the number called for will probably overstock or understock the stream as the case may be, or again this stream or lake is a fish trap and the entire plant is soomed to destruction due to irrigation, lack of water in dry seasons, etc. It may be that he will not even realize these conditions, arriving in late afternoon and departing blissfully ignorant of the success or failure of his planting. To remedy this situation a physical and biological survey of all fish producing streams would be the ideal solution to the planting problem. But obviously the cost of such a survey would be excessive. As an alternative the reconnaissance survey suggests itself. This would be a cursory survey in which the local inhabitants and sportsmen are interviewed to determine fishing and physical conditions of the various streams and lakes in their vicinity, and an actual superficial inspection of these waters as to physical and biological conditions, to be conducted by the fish culturist of the hatchery in that vicinity. This type of survey would give an idea of the species of fish, amount of food available, extent of hazards to fish life, etc. of the various lakes and streams examined in this manner.

I do not say that these suggestions would be a panacea to all the fish planting ills but I do believe that they would help materially in transporting more fish from the hatchery ponds to the angler's hook.

R. E. Burrows,
Apprentice Fish Culturist,
U. S. Fisheries Station,
Dexter, New Mexico.

NOTES AND NEWS

DISEASES OF FISH ACT: NEW MEASURE COMES INTO FORCE IN ENGLAND

(Reprinted from The Fish Trades Gazette, London, Oct. 30, 1937)

THE DISEASES of Fish Act becomes operative on November 1, 1937. Under its provisions the importation of life fish of the salmon family is prohibited and the importation of live fish eggs or fresh water fish is regulated and subject to license. Application for licenses for importation into England and Wales should be made to the Fisheries Secretary, Ministry of Agriculture and Fisheries ; in Scotland, the Secretary of State has delegated powers to the Fishery Board for Scotland and application for licenses in that country should be made to the Secretary, Fishery Board for Scotland, Edinburgh.

The Act also provides for the notification of the disease known as furunculosis and occupiers of rivers, streams, lakes and fish farms (including private stews) where furunculosis is known to exist, or in which they have reason to suspect the presence of the disease, must forthwith report the fact or suspicion.

WASHINGTON SPORTSMAN'S CLUB URGES AN EIGHT-INCH LIMIT FOR TROUT

THE TIME is long since gone when the waters of Washington were teeming with trout and the fisherman could catch a dozen 15 inch fish in half an hour. WHY? Continued fishing by an ever increasing population has done it. Now we are faced, not with conservation, but with restoration. The State Game Department is making mighty efforts to accomplish this.

But we must do our part. HOW? The most helpful way is to boost for an eight-inch limit instead of the present six-inch limit. Here are the reasons:

Reason No. 1. SPORTSMANSHIP.

Everyone admits his trout cost from a dollar a pound on up. Trout fishing is a sport and we pride ourselves on being sportsmen. Who gets any sport from dragging in a six inch fish too feeble to unwind the line from his reel? No one — not even the fish. Catching six inch fish is not sport.

Reason No. 2. WASTE.

There are two bites of meat on a six inch trout -- one on one side and one on the other. The average Washington fisherman's catch is eight -- when he gets any. The average family consists of four persons. Figure it out for yourself -- four bites apiece. Even a limit catch must be eked out with bacon and eggs next morning. Calling six inch trout "food" is a gross exaggeration.

Reason No. 3. CONSERVATION.

Every sportsman knows what a mature Salmon or Steelhead looks like. But he does not recognize them in their childhood. Three-fourths of the six inch fish now caught in streams are young Salmon or Steelhead on their way to salt water. Ask any State biologist. Spare the six inch fish and seven times out of ten you'll catch him later as a ten pound Steelhead or a forty pound Salmon. He will grow up in salt water without your help. Catch the six inch fish and you waste the natural increase of which he is capable. This is not conservation. It is not even good sense.

Reason No. 4. ECONOMY.

Organized sports clubs now plant thousands of trout fry annually in upper streams and high lakes. The state is planning an intensive program of stocking higher waters with its own forces. This work costs much in labor and money. The year after the fry are planted they are six to seven inches long and are legally taken by sportsmen. A miserable harvest compared to the cost of planting, in dollars, sweat, and weariness. The second year after planting the fish will all be eight inches or over. Their value to the sportsmen then is four times as great - twice as much fight and twice as much food. A six inch fish represents 25¢ on the dollar it cost to plant the fry. Catching six inch fish is not economy.

Reason No. 5. PROTECTION.

In New York the fishermen follow the hatchery tank trucks to the stream that is planted. They catch the six inch fingerling right after he is released. The banks are lined with anglers - out of the tank and onto the hook. Do we want the same situation? Our State Game Department will eventually plant only six inch fish or longer in lower waters accessible to trucks. Under the six inch limit these fingerlings can be taken as soon as released. These plants cannot be protected under the present limit. Catching six inch fish is not protection to fingerling plants.

LET'S TAKE THIS STEP FORWARD!

Yours for an eight-inch limit,

THE TRAIL BLAZERS,
Seattle, Wash.

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